This month we would like to present reports by LCI students who recently attended conferences with the intent of gathering information for IPP members. One was the **International Liquid Crystal Conference** in Korea. (http://www.ilcc2008.org/index.htm). We have extensive notes on many of the presented papers and several of the posters.

One example is the keynote address “Limitations and Success Factors of LCD” by Jun Souk, Executive VP at Samsung Electronics. He presented his view that at the current time the IPS and VA are satisfying the market, but new advancements are desired. In the shorter term, he would like to see modifications to allow: less than 3msec switching time; elimination of the viewing angle problem completely; and higher transmittance. Looking for new liquid crystal technologies that might allow this performance, he highlighted recent work in: biaxial nematics; the blue phase; and cholesteric liquid crystals, and showed a display from Kent Displays Inc.

Looking further into the future, he made the point that displays will need to open new applications if the growth rate is to continue. Display characteristics that could allow this are: increased realism (larger, higher resolution, 3D); greater portability (outside viewability, low power); paperlike; and improved color quality. It was interesting that in these discussions he again showed a display from Kent Displays Inc.

If you would like further information about this talk, or on those covering another topic you are interested in, please let us know.

Because many of our current IPP members have interests in the use of LC devices for optical applications, Mitya Rezinkov (who is getting ready to graduate and is looking for employment!) attended (and gave an oral paper) at the **2nd International Workshop on Liquid Crystals for Photonics**, July 21-23, 2008, Wolfson College, Cambridge, U.K., and filed this report:

Topics of the workshop talks included non-linear optical effects, LCOS for displays and switching components, LCs in waveguides and switches, microwave applications of LCs, lasing in LCs, liquid crystal alignment, 2D- and 3D-modeling of LCs and nanoparticles in LC.

In the plenary talk, ‘**Liquid crystalline nonlinear optical meta-materials**’, Iam-Choon Khoo discussed the underlying mechanisms such as multi-photonics adsorptions, density, temperature and order parameter fluctuations, collective molecular orientation processes and some devices/structures for optical switching, modulation and optical meta-materials with unconventional refractive indices. In particular, attention was paid to nematic liquid crystals doped with dye and nano-particles for controlling transmission of light.

Among invited talks, for me the most interesting was ‘**Measurements of azimuthal anchoring energies**’ by Sandro Faetti. Two high accuracy methods of measuring surface director azimuthal angle have been described (transmission and reflective optical methods), which allow, in particular, to obtain values of azimuthal anchoring energy even in the case of very strong anchoring (correlation length of nm order of magnitude). Also, influence of gliding on experimental measurements has been discussed.
Chigrinov talked about photo-alignment utilizing azo dyes (Photo aligning of liquid crystals utilizing new azo dyes: Characteristic properties and physics of applications). In particular, he mentioned successful utilizing of these materials to align IAC materials for V-shaped switching.

In ‘Azo-containing polymer brushes: photo-alignment and application as command surfaces’, P. Camorani pointed out how polymer brushes are very attractive for applications as command surfaces due to high stability (due to covalent bonds between chain and substrate) and the possibility of fine control of the structure (chain length is controlled by time of polymerization). Both photomechanical effects (photo-induced expansion and shrinking) and photo-alignment were investigated as function of temperature, illumination and brush length.

Yuri Reznikov’s talk was ‘Diluted LC nanocolloids - Problems and perspectives’, dedicated to colloids of ferroelectric nanoparticles in single-component nematic LCs and LC mixtures. Embedding submicron ferroelectric particles of Sn_2P_2S_6 in 5CB liquid crystal causes strong increase of order parameter, clearing temperature, dielectric anisotropy and birefringence. Data are well described by an enhancement of the orientation coupling in a LC due to strong electric field produced by the permanent polarization of the ferroelectric particles. However, the proposed model does not work for the case of multi-component mixtures, which may be explained by spatial micro-separation or selective adsorption of the molecular components of the mixture.

In the talk presented by G.D’Alessandro, ‘Liquid crystal configuration effects on the band-gap frequency of a tunable waveguide’ theoretical study of the liquid crystal configuration in a cell with in-plane electrodes in a channel geometry is presented. This model is a good basis for understanding the liquid crystal behavior occurring in certain LC-based optical waveguide devices. Grating imprinted on the waveguide creates an optical reflection or band-gap where transmission is reduced. Central frequency of the gap depends on the configuration of liquid crystal. Experiments have shown that the band-gap frequency shifts with the applied voltage independently of the mode of the waveguide and that it shows hysteresis. Liquid crystal configuration is modeled in the presence of the non-uniform electric field and it is shown how different aspects of the liquid crystal configuration can explain observed experimental results.

Finally, Eric Yao in his talk ‘Applications of Spatial Light Modulators’ showed very interesting applications, in particular, using of SLMs in interactive optical tweezers where users can view, trap and manipulate (in 3D) multiple macroscopic particles and using of SLMs with high spatial resolution to display light shaping holograms which are used to create complex light beams. Optically addressed SLMs (OSLMs) are preferable from the point of view of fill factor and optical flatness, and LCOS devices have higher spatial resolution (which allows, for instance, better control of the traps’ positions in the optical tweezers). By combining two high resolution LCOS displays and a large aperture OSLM, a 4-megapixel OSLM was developed. Also SLMs are used to affect precise control of the phase and intensity of the beams. Interference of multiple light beams can give raise to optical vortices (phase singularities). Vortex lines of different topological structures can be created within light beam by SLM to control the directions, relative phases and intensities of a number of interfering light beams.

LCI NEWS

Remembering Alfred Saupe (1925-2008)

Alfred Saupe, the grandfather of liquid crystals, died August 2, in Badenweiler, Germany, where he was born in 1925.

Saupe earned his doctorate from the University of Freiburg in 1958. This work resulted in the most successful mean-field theory of the isotropic nematic transition, known as the Maier-Saupe theory. In 1968, he moved to Kent State University, where, in 1969, he published another seminal work in which he not only proposed the first valid
microscopic model of blue phases, but also predicted the helical structures of chiral SmC materials and laid down the elastic theory of tilted smectic phases.

Not less important was his discovery of the biaxiality in lyotropic nematic liquid crystals in 1980, and his subsequent continuum theory of these materials. Other achievements while at Kent are the proposed technique of liquid crystal-NMR which is currently used to decipher the structure of complex molecules by placing them in the liquid crystal matrix, and observation of the optically induced reorientation. Since the 1990s, he has been working on ferroelectric liquid crystal materials and polymer liquid crystal composites, leading to the explanation of the piezoelectricity and of the microscopic structures of the polymers in liquid crystals. Saupe retired from the university with emeritus status in 1992 and moved back to Germany.

Even after retiring and while suffering from Parkinsons disease, Saupe was actively involved in working on the K13 problem, and on a textbook (One-and two-dimensional fluids, co-authored by Antal (Tony) Jakli) aimed for graduate students and novices in the science of liquid crystals, published in 2006. He also continued to maintain a close collaboration with researchers in Kent. Saupe received numerous awards, such as the Nernst Prize in 1974, Humboldt Prize in 1987, Kent State Presidents Medal in 1992 and the Freedericksz Medals in 1999. He was also one of the first honored members of the International Liquid Crystal Society in 1998.

Nobel Laureate, P.G. de Gennes wrote about Al: “I personally met A. Saupe at a rather late stage, when I first visited the Mecca of Liquid Crystals around 1970, Kent State University. Saupe was then famous for his rigorous studies of alignment via nuclear resonance, but what I remember is the good will of my hosts, G. Brown and A. Saupe, facing a young theorist who knew very little about chemical physics and even less about liquid crystals. Their open minds, their will to show me the maximum, their sense of cooperation, impressed me enormously. I shall not forget those happy years.” (P.G. de Gennes, Paris, February 1996)

Saupe is survived by his loving wife, Brigitte, and three children Anya, Welfy and Arne who understood him even when he was overwhelmed with work or with the disease. He will be missed not only by his family and friends, but also by the entire liquid crystal community.

**Wei secures three-year NSF research grant on biosensors**

Prof. Qihuo Wei has recently secured a research grant from the National Science Foundation (NSF), Division of Electrical, Communications and Cyber Systems. The award will support a three-year project on "Scaling laws for nano-field-effect-transistor biosensors" performed collaboratively by researchers at Kent State University (lead institution) and Ohio State University. Wei is the Principal Investigator of the project. The goal of this project is to develop fundamental understanding of the limits of sensitivity and detection thresholds of nanoscale field effect transistor biosensors.

**Liquid Crystal Day 2008 set for September 5**

The Liquid Crystal Day 2008 Symposium will be held on Friday, **September 19**, from 8:30 a.m. to 5:30 p.m. in the Samsung Auditorium, located on the first floor of the Liquid Crystal and Materials Sciences Building. Registration is required in advance online at: [http://www.lcd.kent.edu](http://www.lcd.kent.edu). Best papers will be awarded in a variety of categories based on experience level. Guests will enjoy presentations, tours of LCI, a student poster session, an industrial exhibition and light refreshments. The event is free and open to the public. If your company would like to provide an exhibit please contact Jim Maxwell (phone: 330-672-7770 or email: [Maxwell@coli.kent.edu](mailto:Maxwell@coli.kent.edu))

Prof. Robijn Bruinsma, Department of Physics, University of California-Los Angeles (UCLA) is the invited speaker and will give a talk in the afternoon. Stay tuned for more information regarding additional invited speakers, awards, industrial exhibitors and a final program. The Liquid Crystal Day planning committee will invite students from around the state of Ohio to attend this event and discover the many outstanding features of the Chemical Physics Interdisciplinary Program at Kent State.
For a detailed schedule of events, visit the Liquid Crystal Day Web site.

New Faces at LCI
Khoa Van Le, a visiting student from Tokyo Institute of Technology, is working in Prof. Jakli's lab 8/5/08 - 10/30/08.

LCI Seminars for Fall Semester

September 10
**Dr. Hiroshi Yokoyama**, National Institute of Advanced Industrial Science and Technology (AIST), "Nano-Craft of Liquid Crystal Surface Alignment: Theory and Implementation"

September 26 (Friday)
**Dr. David Siegel**, Givaudan Flavors Corporation, Cincinnati, OH, "Membrane Fusion: just a Passing Phase"
Note: This is a joint seminar with Department of Biological Sciences.

October 15
**Prof. Paul Cremer**, Department of Chemistry, Texas A&M University, "Using Supported Bilayers as a Separation Matrix for Proteomics"

November 5
**Prof. Peixuan Guo**, Dane and Mary Louise Miller Endowed Chair in Biomedical Engineering, University of Cincinnati, Title: T.B.A.
Note: This is a joint seminar with the Department of Biological Sciences.

November 19
**Prof. Nongjian Tao**, Department of Electrical Engineering & School of Materials Research, Arizona State University, Title: T.B.A.

December 10
**Prof. Nader Engheta**, H. Nedwill Ramsey Professor of Electrical and Systems Engineering, and Professor of Bioengineering, University of Pennsylvania, "Circuits with Light at the Nanoscale: Metananocircuits and Metaelectronics"

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